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Supporting the “The Right Stuff”: Looking Back at the Navy Medical Department and the Mercury Space Program

Filed under [A LOOK BACK](#), [Navy Medicine History](#) {[2 comments](#)}

Part I: The Johnsville Human Centrifuge

By André B. Sobocinski, historian, U.S. Navy Bureau of Medicine and Surgery

“Here is a multimillion-dollar unique device developed by the Navy, but of such capability that it has received worldwide attention. It has been employed and will be employed as a tool for solving problems of interest to not only the Navy but to the USAF, NASA, industry, and science.”

~Capt. Clifford P. Phoebus, MC, USN, December 1959



The Mercury Seven posing for portrait in their pressure suits, 1959. Courtesy of NASA Johnson Space Center Collection

In 1959, the National Aeronautical Space Administration (NASA) embarked on an ambitious program to prepare seven military pilots for the first man-in-space program (Project Mercury). Over the next several years, NASA would send its “Mercury Seven” through a gauntlet of classes, training and tests across the United States to ensure they had the “right stuff” for orbital flight.

From the very beginning of the space program, the Navy Medical Department would serve as an important collaborator with NASA. Our physicians and scientists would act as NASA advisors and medical monitors; and Navy medical research institutions in Bethesda, Maryland, New London, Connecticut, Pensacola, Florida and Warminster, Pennsylvania would help ensure the success of Project Mercury.



The Johnsville Centrifuge, ca. 1959. Courtesy of NASA Johnson Space Center Collection

The Aviation Medical Acceleration Laboratory (AMAL) was one of the institutions vital to man's journey into space. Established in 1949 at the Naval Air Development Station in Warminster, Pennsylvania, AMAL was the home of the largest centrifuge in the world. Constructed by the McKiernan-Terry Corporation under the cognizance of the Special Devices Center of the Office of Naval Research, the centrifuge was housed in a 125-foot diameter room and consisted of a gondola on the end of a 50-foot arm mounted on one of the largest DC motors in existence—a 180-ton, 4,000 horsepower General Electric motor with peak burst of 16,000 horsepower. The device could accelerate from 0-173 miles per hour in just 7 seconds generating 40 G's of radial acceleration. It was built on land that was 98 percent bedrock and what was considered “the most stable piece of land in North America.”

In essence, the centrifuge was a flight simulator built to test resilience to G(ravity)-forces and also techniques for reducing G-LOC (gravity-induced loss of consciousness). From 1959 to 1963, the centrifuge was used almost exclusively by NASA to evaluate anti-blackout procedures, to simulate conditions of the Mercury capsule above 27,000 feet, the acceleration profiles of boost phases and re-entry phases, and also used to study the astronaut full-pressure suit.



Astronaut Virgil (Gus) Grissom seen preparing for training in centrifuge at AMAL. A Navy Corpsman attaches sensors to Grissom to monitor his body's reaction to the centrifuge. Courtesy of NASA Johnson Space Center Collection

Each of the Mercury Seven would spend about 10 hours in the centrifuge. John Glenn called the centrifuge “sadistic” and “dreaded.” Alan Shepard would call it the most important preparation for his historic May 5, 1961 flight into space. Even Ham, the first chimp in space, underwent acceleration training at AMAL.

AMAL’s centrifuge continued to be used to train astronauts into the 1980s. Its last run took place in 2005.

Today, the old centrifuge is still in existence and now part of the Johnsville Centrifuge and Science Museum in Warminster, Pennsylvania.

This is part one of a four part series. Stay tuned for part two featuring the Naval School of Aviation Medicine and the Human Disorientation Device.

Written on August 11, 2016 at 7:00 pm by [Navy Medicine](#)

Supporting the “The Right Stuff”: Looking Back at the Navy Medical Department and the Mercury Space Program Part II

Filed under [A Look Back](#), [Research and development](#) {[2 comments](#)}

Part II: The Naval School of Aviation Medicine and the Human Disorientation Device

“You tumbled slowly, twisted and rolled as your body lurched against the tight harness that strapped you to a couch. Then you rotated faster and faster until finally you were spinning violently in three different directions at once—head over heels, round and round as if you were on a merry-go-round, and sideways as if your arms and legs were tied to the spokes of a wheel. It was a wild and sickening sensation. Your vision blurred. Your forehead broke out into a cold, clammy sweat... [and] you could get sick enough to vomit.”

~Virgil I. (Gus) Grissom on Human Disorientation Training, *We Seven*, 1962



Virgil “Gus” Grissom. Grissom would quip that Mercury Seven moved so fast from one training facility to another that in some cases they “outran” the people who were training them. Courtesy of NASA Johnson Space Center Collection

From 1959 until the launch of Alan Shepard’s *Freedom 7* capsule in May 1961, the Mercury Seven went through an almost continuous regimen of training and medical tests to prepare them for spaceflight. Gus Grissom would later quip that the Mercury Seven moved so fast from one training facility to another that in some cases they “outran” the people who were training them.

The schedule of America’s first astronauts may have been “disorienting” at times; it could also be said that on occasion their training was designed to be so. This certainly was the case in 1959 when they went through the Naval School of Aviation Medicine in Pensacola, Florida.

The Naval School of Aviation Medicine, later known as the Naval Aerospace Medical Institute (NAMI), has historically been responsible for ensuring physical standards and qualifications of pilots and training aviation

medical personnel for operational assignments. For the first decades of its existence (1939-1970), NAMI also operated an extensive basic and applied research laboratory.



Capt. Ashton Graybiel, MC, USN. A giant in the field of aerospace medical research, Graybiel has been credited for planning the Navy's participation in the medical aspects of Project Mercury. BUMED Archives

Under the leadership of legendary aerospace medical researcher Capt. Ashton Graybiel, MC, USN (1902-1995), NAMI's research component explored the effects of fatigue, vestibular physiology, neurological science, cosmic radiation and cardiovascular fitness, all of which would prove invaluable for the first manned space flights. NAMI operated special laboratories for researching spectroscopy, nuclear admission, low-level alpha radiation, medical electronics, ballisto-cardiography and bioacoustics/psychoacoustics. But NAMI also housed two large training devices that set it apart from other aerospace research laboratories.

NAMI's human disorientation device (HDD) and "slow rotation room" were both designed for studying human-performance in motion-based environments and, ultimately, for learning adaptation techniques, training procedures and how drugs could reduce symptoms of disorientation.

First constructed in the 1958 at a cost of \$1 million, the HDD was once described in *LIFE* Magazine as looking like an "automatic cocktail shaker." The HDD was a large aluminum cylinder that contained a standard pilot seat and a doorway or trapdoor. Test subjects would be strapped into the device and rotated vertically and horizontally to induce vertigo.



The Navy's Vestibular Physiology Lab containing the HDD, Slow Rotation Room and other devices used to study the effects of disorientation. BUMED Archives

As its name implied, NAMI's slow rotation room simulated "slowly rotating artificial gravitational environments." Constructed in a plywood room 15 feet in diameter and 10 feet high with padded walls, the room contained two automobile seats that faced instrument dials, an electric stove, shelves stocked with canned goods and books and a number of testing devices (e.g, trashcan for throwing tennis balls into while the room rotated). The slow moving room could be programmed to rotate at variable speeds for and durations. Test subjects could stay in the room from hours to days.

NAMI would continue to collaborate with NASA well beyond Project Mercury. Its research laboratory was later designated as the Naval Aerospace Medical Research Laboratory (NAMRL) in 1970; four years later, it would become a separate command. In 2011, NAMRL relocated from Pensacola to Wright-Patterson Air Force Base, Ohio and was renamed the Naval Medical Research Unit (NAMRU)-Dayton. Today NAMRU-Dayton continues on the proud tradition of its forbear.

This is part two of a four part series. Stay tuned for part three featuring the Mercury Seven and the Naval Medical Research Institute.

Previous installments of "Supporting the "The Right Stuff": Looking Back at the Navy Medical Department and the Mercury Space Program":

[Part I: The Johnsville Human Centrifuge](#)

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Supporting the “The Right Stuff”: Looking Back at the Navy Medical Department and the Mercury Space Program Part III

Filed under [A Look Back](#), [Research and development](#) {[no comments](#)}

Part III: The Mercury Seven Visit Naval Medical Research Institute

“We spent two years doing many things and following up many avenues to make sure we had not overlooked anything. We crammed ourselves full of knowledge. We built up our stamina on the big machines. And we got thoroughly familiar with the spacecraft that we would fly. Some of this was fairly exotic stuff...For we were preparing to penetrate an environment that no one had ever dealt with before. Some of it, however, was just plain down-to-earth work.”

~Alan Shepard, Jr., *We Seven*, 1962

On March 12, 1959, Dr. Robert Gilruth, director of NASA's Project Mercury asked the Naval Medical Research Institute (NMRI) in Bethesda, Maryland, for assistance “in procuring and preparing” test animals for investigation of acceleration forces related to rocket flight and recovery. Just two months later NASA would again call upon NMRI, this time to be part of a comprehensive training program to provide the astronauts the “best available experience” related to space flight operations.

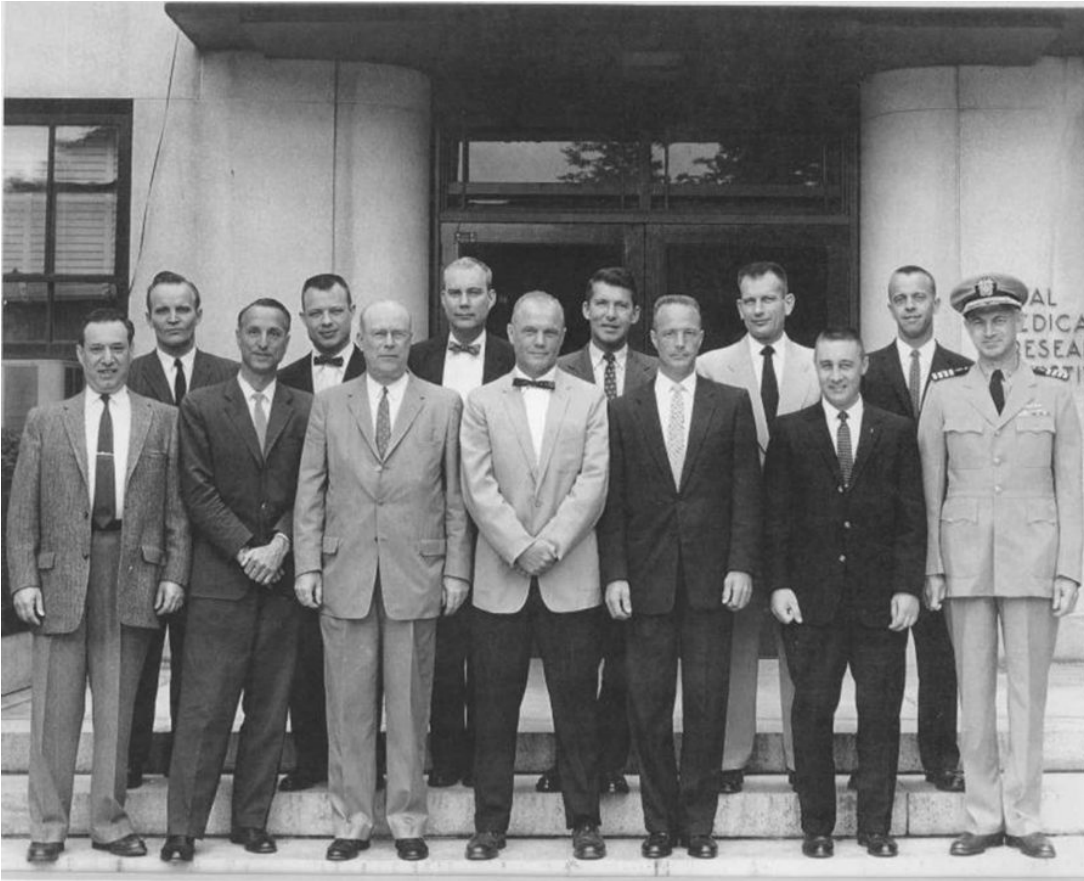


Naval Medical Research Institute in Bethesda, Md. Established on October 27, 1942 at the National Naval Medical Center in Bethesda, Md., NMRI would chart an ambitious course of research and development throughout World War II and beyond. In 1998, NMRI was reorganized as the Naval Medical Research Center (NMRC). BUMED Archives.

Since its commissioning on Oct. 27, 1942, NMRI had grown from a wartime test and development command to the Navy's preeminent medical research laboratory. From endocrinology to biophysics, organ transplantation

and experimental surgery to hot and cold weather medicine, NMRI was on the vanguard of unlocking the great mysteries of biomedical science.

The Mercury Seven were scheduled to visit NMRI over a two-week period in 1959 (June 1 to 13) and take part in a series of training activities designed to acquaint them with the command's capabilities and prepare them for space flight.



Mercury Seven at NMRI, ca. 1959. Mercury astronauts stand in front of the NMRI flanked by Navy and NASA scientists. Dr. Theodor Benzinger, head of NMRI's Bioenergetics Division and developer of the human gradient calorimeter and ear thermometer, can be seen standing in the front row, second from left. Courtesy of NMRC

The astronauts spent two hours in NMRI's low-pressure chamber and subjected to an atmosphere of three percent carbon dioxide. A NASA documentary film of this shows the astronauts huddled in the chamber dressed in business attire (white shirt, tie, and pocket pens) playing cards, jotting notes and conversing with each other. While in space, there was a danger of the capsule's environmental control systems failing leading to increased carbon dioxide levels in the cabin. The Mercury astronauts would have to be prepared to withstand such conditions while making orbit around earth and for reentry.

Maintaining an optimal body temperature in space was another medical concern for the astronauts. While at NMRI, each astronaut spent time in the human gradient calorimeter to test their heat tolerance. Designed by NMRI scientist and biothermodynamics pioneer Dr. Theodor Benzinger, the calorimeter allowed for the study of human temperature regulation, heat production and loss. It also enabled scientists to establish the heat exchange of each astronaut while allowing them to become familiar with their own body's thermal response.

This is part three of a four part series. Stay tuned for part four featuring the Mercury Seven and the Naval Medicine's role in bioastronautics and medical recovery.

Written on August 25, 2016 at 7:00 pm by [Navy Medicine](#)

Supporting the “The Right Stuff”: Looking Back at the Navy Medical Department and the Mercury Space Program Part IV

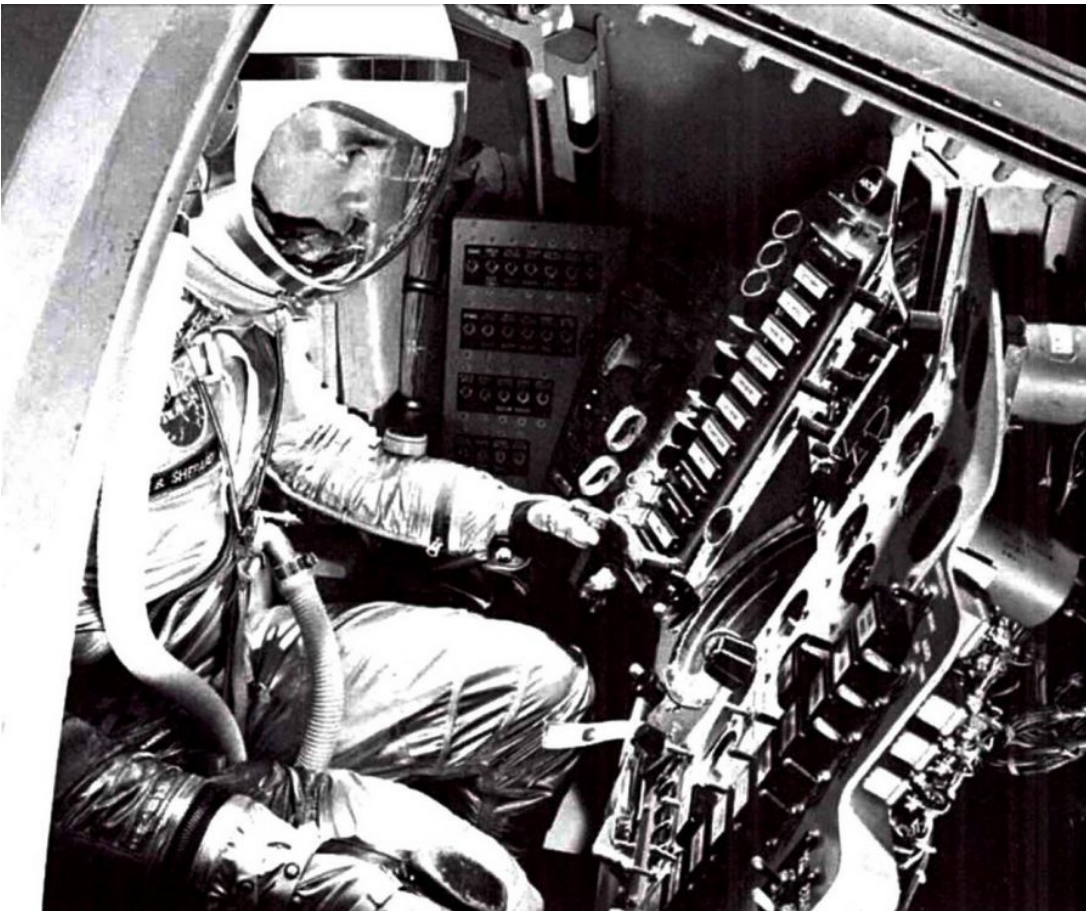
Filed under [A Look Back](#) {[no comments](#)}

Part IV: Bioastronautics and Medical Recovery

It was a strange and exciting sensation. And yet it was so mild and easy—much like the rides we had experienced in our trainers—that it somehow seemed very familiar. I felt as if I had experienced the whole thing before....Nothing could possibly simulate in every detail the real thing that I was going through at that moment, and I tried very hard to figure out all of the sensations and to pin them down in my mind in words which I could use later. I knew that the people back on the ground—the engineers, doctors and psychiatrists—would be very curious about how I was affected by each sensation and that they would ask me quite a lot of questions when I got back.

~Alan Shepard, *We Seven*

On May 5, 1961, Alan Shepard rocketed into history aboard his *Freedom 7* capsule. The flight was the culmination of three-years of extensive and rigorous preparations for the then uncharted journey into space. The inaugural manned space flight also marked a new phase of the *Mercury* program—medical monitoring and recovery.

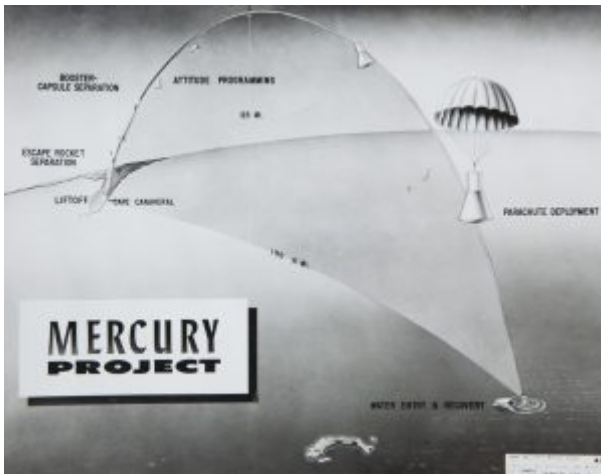


Alan Shepard inside trainer capsule prior to take-off. The Mercury space capsules were every bit rocket-powered laboratories. Inside each capsule the astronaut was connected to a host biosensors that telemetered data to aeromedical monitors below. In case of medical emergency, monitors could abruptly terminate the spaceflight. Courtesy of NASA Johnson Space Center Collection

Medical monitoring of spaceflights was first proposed by Dr. Stanley White, of the Mercury Space Task Group. In a memorandum dated October 1959, White emphasized the importance of tracking the health and well-being of the astronaut during flight and that the data collected could be used for future post-flight research.

Within each Mercury capsule the astronaut was attached to an assortment of sensors that tracked their heart rates, respiration, body temperature, blood pressure and telemetrically related the data to the ground stations. Navy, Army and Air Force medical personnel serving as aeromedical monitors made clinical assessments based on the incoming data and, if necessary, would determine whether the mission needed to be suddenly terminated.

Just as the astronauts had done previously, the aeromedical monitors underwent an extensive training program. From October through December 1960, monitors became acquainted with the astronauts, their training program, EKG procedures, environmental systems, the full-pressure suit, biosensors and other monitoring equipment, and received up-to-date briefings on the Mercury Project. During the spaceflights, the monitors were assigned to 16 tracking and monitoring stations located across the globe.



The Project Mercury “Medical Recovery” operation was designed by Capt. Ashton Graybiel, MC, USN, of the U.S. Naval School of Aviation Medicine. Graybiel’s plan guaranteed that wherever the returning astronaut landed they would be recovered and given needed medical attention within three hours. Here we see the trajectory of Alan Shepard’s historic flight on May 5, 1961. Courtesy of NASA Johnson Space Center Collection

The other vital medical component of Project Mercury was the recovery mission. Capt. Ashton Graybiel, director of research, U.S. Navy School of Aviation Medicine, designed a medical recovery mission to ensure that the returning astronauts received needed and timely medical attention. Physicians designated to take part in recovery and post-flight check-up would pay special attention to the effects of high acceleration, weightlessness, rapid deceleration, and disorientation.

Three Air Force and one Navy medical facility (U.S. Naval Hospital Yokosuka) were designated to serve as “Project Mercury recovery support hospitals.”

The Navy was the designated lead for the recovery operation. Per Graybiel’s proposal, medical personnel were stationed aboard destroyers, dock landing ships (LSDs), aircraft carriers and at key shore points around the globe. Because of the distribution of these components the returning astronaut was guaranteed medical attention within three hours of landing.

Graybiel's plan was tested by Mercury's inaugural flight in May 1961. After a 15-minute suborbital flight, Shepard's capsule parachuted down just over 300 miles southeast of Cape Canaveral. A Sikorsky helicopter retrieved Shepard and delivered him to the *Essex*-class aircraft carrier USS *Lake Champlain* (CV-39) where medical personnel and media anxiously awaited. Navy physician Capt. (later Rear Adm.) Robert Laning who performed the post-mission check-up later recalled, "It was as complete as it could be without X-rays, including a neurological examination. Of course, we had those facilities available in sick bay. If he had been injured, we would have determined that when he got off the helicopter."

Shepard's launch in 1961 was followed by five more Mercury flights. Due to an atrial fibrillation, astronaut Deke Slayton was the only Mercury astronaut not to take part in spaceflight (Slayton was later cleared to fly during the Apollo Project).

Collectively, the Mercury astronauts logged two days and six hours in space. Without question Project Mercury was a resounding success, even though everything about it—i.e, training, planning and research—could be called experimental. However, without a little ingenuity and imagination as well as some of the "right stuff" there would be no Gemini Project, Apollo moon mission or Skylab. The Space Race would have been a foregone and the United States would have lost.

This is the final part of our four part series "The Right Stuff": Looking Back at the Navy Medical Department and the Mercury Space Program.

Previous installments of "Supporting the "The Right Stuff": Looking Back at the Navy Medical Department and the Mercury Space Program":

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